

## CHANGED CONDITIONS SINCE THE LAST DROUGHT

In the relatively short time since the 1987-92 drought, significant changes in California's water management framework have occurred. This chapter describes the changes and discusses their water management implications.

### LEGAL, REGULATORY, AND INSTITUTIONAL CHANGES

Heightened interest in supply reliability created by the drought, together with drought-induced ecosystem impacts, were factors leading to the development of some of the changes summarized below. The changes have mixed impacts on water agencies' abilities to respond to the next drought—some lessen water supply reliability and some improve it. The

following descriptions focus on aspects of the laws, regulations, or institutional changes that could most affect drought-related water supply availability and water agencies' ability to respond to droughts.

- In 1992, the National Marine Fisheries Service issued its first biological opinion for winter-run chinook salmon, then listed as threatened under the Endangered Species Act. NMFS followed with a 1993 long-term biological opinion; winter-run were reclassified to endangered status in 1994. Both biological opinions incorporated changes to CVP operations to provide additional cold water in spawning areas downstream from Shasta Dam, and closures of Delta Cross-Channel gates. The 1993 opinion also provided for numerical take



*Delta smelt, native to the Bay-Delta, have a one-year life span and a relatively low reproduction rate, making their population abundance sensitive to short-term habitat changes. CVP and SWP exports from the Delta must be curtailed when smelt congregate in the South Delta near the pumping plants. SWP export curtailments in 1999 to protect the smelt delayed San Luis Reservoir filling and resulted in an estimated loss of 150 taf of interruptible water for project contractors.*



*Castaic Lake Water Agency takes delivery of its SWP entitlement at Castaic Lake. CLWA recently purchased 41 taf of SWP entitlement from KCWA, pursuant to the SWP's Monterey Amendments, and has pending two additional purchases totaling about 19.5 taf.*

limits at Banks and Tracy Pumping Plants, and for further temperature control operations at Lake Shasta. The CVP was required to maintain a minimum Shasta September storage of at least 1.9 maf, except in the driest years. (Shasta storage declined to 0.6 maf during the 1976-77 drought, and to 1.3 maf during the 1987-92 drought.)

- The Central Valley Project Improvement Act of 1992 reallocated 800 taf of CVP water supply from project contractors to fishery purposes, plus additional project supply to provide firm water for wildlife refuges. Annual Trinity River instream flows of at least 340 taf were to be provided until a flow study conducted by the U.S. Fish and Wildlife Service was completed, at which time new flow requirements would be established. The act directed the Secretary of the Interior to carry out structural and nonstructural environmental restoration actions, including water acquisition for fishery and wildlife refuge purposes. One major structural restoration project affecting river operations has been completed—the \$80+ million Shasta Dam Temperature Control Device, which reduces the need to forgo power generation at Shasta to provide cold water for salmon. CVPIA also authorized transfers of project water outside the CVP's service area, subject to many conditions. Some conditions, such as right of first refusal by entities within the service area, expired in 1999. To date, no out-of-service area transfers have occurred. The Secretary was authorized to carry out a land retirement program, targeted at drainage problem lands in the San Joaquin Valley. USBR is working with Westlands Water District to implement a land retirement program within the district.
- Delta smelt were listed as threatened in 1993. The primary water management action associated with their listing has been reduction of CVP and SWP exports from the Delta.
- The 1993 Emergency Services Act required OES, in coordination with other State agencies, to have

a standardized emergency management system operational throughout California by the end of 1996. Local agencies are strongly encouraged to use SEMS, and must use it to be eligible for State funding of emergency response costs. SEMS incorporates the State's master mutual aid program. In response to a request from OES, or from a local agency via the mutual aid program, the Department must provide emergency response assistance, if resources are available. While drought *per se* is not an emergency, drought-related impacts, such as a local agency running out of water, could trigger a request for the Department to provide assistance in actions such as constructing a temporary pipeline.

- The Monterey Agreement, signed by the Department and SWP contractors in 1994, established principles to be incorporated in contract amendments (the Monterey Amendments) to be offered to the contractors. To date, all but two contractors (Plumas County Flood Control and Water Conservation District and Empire West Side Irrigation District) have accepted the amendments. The amendments changed the prior method of allocating water supply deficiencies, which reduced supplies to agricultural contractors before those of urban contractors were cut. Supplies are now to be allocated among contractors in proportion to their contractual entitlements. The amendments also reduced the SWP's total contractual commitment as part of transferring KWB lands to two contractors, and further provided that 130 taf of agricultural contractors' entitlements could be sold to urban contractors. Several amendment provisions gave contractors more flexibility in managing their SWP and non-SWP supplies. Contractors are allowed to store project water outside their service area boundaries and to have access to project facilities for wheeling non-project water. Agreements have already been executed with some contractors to enable storage of SWP water outside contractors' service areas. Examples include those with MWD, Santa Clara Valley Water District, ACWD, and Zone 7 Water Agency to allow them to store SWP water in SWSD's groundwater bank. The amendments allowed contractors participating in repayment costs of Castaic and Perris Reservoirs to conditionally withdraw water from the reservoirs, subject to replacement of the water within five years. The amendments also created a turnback

pool (first operated in 1996) for internal annual reallocation of project water among project contractors, and provided dry-year rate relief for agricultural contractors.

- SWRCB adopted Decision 1631 in 1994, amending the City of Los Angeles' rights to divert from the Mono Lake Basin, in order to increase Mono Lake levels. The decision restricted diversions from the basin to 16 taf/year until the lake level reached elevation 6391, at which time diversions would be allowed to increase to about 31 taf/year, about one-third of historical diversions. (As of May 2000, the lake's elevation is 6384.5 feet.) Los Angeles implemented an aggressive water conservation program emphasizing plumbing fixture retrofits—with substantial State financial assistance—to help compensate for the shortfall. The City estimated that it replaced 750,000 toilets during the 1990s. Between 1994 and 1999, the Legislature appropriated \$17.5 million out of an authorized \$36 million to help Los Angeles implement demand reduction measures.
- The Bay-Delta Accord, executed as a three-year agreement in 1994 and then subsequently extended, set forth the State-federal CALFED Bay-Delta Program's three chief activities—establishing water quality standards, coordinating operations of the CVP and SWP to meet water quality and environmental protection requirements, and developing a long-term solution to Delta problems. In 1995, SWRCB adopted a water quality control plan incorporating concepts contained in the Accord, followed by an interim order. Order WR 95-6 provided that the CVP and SWP would meet Bay-Delta Accord standards while SWRCB developed a new water right decision to apportion the responsibility for meeting standards among all users of Delta water. SWRCB's process to develop a new decision remains ongoing. Table 5 summarizes major changes from the former D-1485 to WR 95-6. CALFED released a first draft programmatic environmental impact report/environmental impact statement for a long-term Delta solution in 1998, followed by a redraft in 1999. A record of decision is scheduled to be signed in 2000, marking the end of CALFED's planning phase and a transition to initial implementation of some CALFED actions, including its environmental restoration program. Other CALFED actions will begin a period of more detailed planning studies. The CALFED June 2000 action frame-

—TABLE 5—

## Major Changes in Delta Criteria from D-1485 to WR 95-6

Criteria	Change
Water Year Classification	From Sacramento River Index to 40-30-30 Index
Sacramento River Flows	Higher September to December Rio Vista flows
San Joaquin River Flows	New minimum flows and pulse flows
Vernalis Salinity Requirement	More restrictive during irrigation season, less restrictive other months
Delta Outflow	Outflow required to maintain 2 part per thousand salinity during February-June
Export Limits	35%-65% export-to-Delta inflow ratio, April-May

work document called for the Governor to appoint a panel charged with developing a drought contingency plan by the end of 2000.

- The Department developed a proposed SWP supplemental water purchase program as a follow-up to the 1994 SWP water purchase program operated jointly with the drought water bank, and released draft programmatic environmental documentation covering a proposed six-year program. The proposed program would have entailed purchasing about 400 taf in drought years, with about half the amount coming from groundwater substitution. The Department did not go forward with the program due to opposition to groundwater substitution transfers in rural Sacramento Valley counties.
- A 1996 Federal Energy Regulatory Commission settlement agreement among the City and County of San Francisco, Modesto Irrigation District, Turlock Irrigation District, DFG, and others provided for increased instream flows in the Tuolumne River. The agreement is estimated to reduce San Francisco's Hetch Hetchy Aqueduct supplies by about 65 taf annually.
- Proposition 218, approved by voters in 1996, changed procedures used by local government agencies for increasing fees, charges, and benefit assessments. Assessments, fees, and charges imposed

as an "incident of property ownership" are now subject to a majority public vote. Water-related charges potentially affected by Proposition 218 include some meter charges, acreage-based irrigation charges, and standby charges. Not all post-Proposition 218 proposed assessments to fund water agency charges have succeeded in receiving voter approval. Most water agencies use a combination of fees for water service and other charges or property assessments to cover operating costs. Depending on an individual agency's fee structure, it could experience financial problems during a drought, when water sales revenues are down and the need for voter approval would limit ability to increase assessments.

- In 1996 and 1997, NMFS listed coho salmon in two coastal areas as threatened. In 1997, NMFS listed two coastal steelhead populations as threatened and one as endangered, followed by 1998 listing of Central Valley steelhead as threatened. In 1999, Central Valley spring-run chinook and coastal chinook were listed as threatened. USFWS listed Sacramento splittail as threatened in 1999, but a July 2000 federal district court decision found that listing to be arbitrary and capricious. The CALFED Operations Group has been serving as the forum for coordinating day-to-day CVP and SWP operations with requirements for

protecting listed species. Decisions have been based on use of near-real-time monitoring data to identify locations of listed migratory and resident species in the Delta and upstream rivers, together with take data at the pumping plants. The CALFED Operations Group has been following adaptive management techniques—selecting a strategy, evaluating its effectiveness, and then either refining the strategy or adopting another approach.

- In 1997, the Colorado River Board released a draft plan outlining steps to reduce California's use of river water to the State's basic 4.4 maf apportionment, in years when surplus river water is not available. California water users have historically exceeded the basic apportionment by as much as 900 taf due to availability of surplus water and Arizona's and Nevada's unused apportionments. MWD is the most junior California water user; if the interstate apportionments were
- enforced in a year when surplus water was not available, the Colorado River Aqueduct would be only half full. Work to complete California's draft Colorado River Water Use Plan is continuing. The plan is based on the concept that the CRA will be kept full through transfers of conserved agricultural water (such as the Imperial Irrigation District/SDCWA transfer), water saved by lining the All American and Coachella Canals, and by implementing new groundwater storage projects. The groundwater storage projects would take surplus river water, when available, and recharge it in groundwater basins near the aqueduct.
- In late 1999, USBR and USFWS released a draft EIS identifying Trinity River instream flow alternatives. From 1981 to 1990, USBR provided instream flows of 287 taf in drought years and 340 taf in wet years. In 1991, the Secretary of the Interior directed that flows be increased to 340 taf per year, the amount subsequently required by



*USBR's Parker Dam on the Colorado River impounds Lake Havasu, the point of diversion for MWD's Colorado River Aqueduct. Since the CRA is the only facility linking the river with urbanized coastal Southern California, its conveyance capacity is the limiting factor on the coastal region's use of river water.*

## THE NATIONAL DROUGHT POLICY COMMISSION

The National Drought Policy Act of 1998 (PL 105-99) called for creation of an advisory commission *to provide advice and recommendations on the creation of an integrated, coordinated federal policy designed to prepare for and respond to serious drought emergencies*. The commission was to be chaired by the Secretary of Agriculture and was charged with submitting a report on national drought policy to Congress. Factors contributing to enactment of the legislation included drought conditions experienced by southeastern and mid-Atlantic states in the latter part of the 1990s, and severe drought impacts to agriculture in states such as Texas and New Mexico in the same time period. The federal response to these agricultural impacts engendered discussion about the relative roles of the U.S. Department of Agriculture and the Federal Emergency Management Agency in providing financial and other assistance.

The National Drought Policy Commission released its report in May 2000. The report stressed planning response actions before droughts occur, to reduce the need for emergency relief actions. The federal role has historically focused on emergency relief actions, not on planning, especially in agricultural programs. The report noted that 88 drought-related federal programs had been funded within the last ten years, with USDA having the greatest federal responsibilities for drought response and assistance programs. Among the report's recommendations was one especially relevant to California—that USGS streamgaging networks be expanded and modernized.

CVPIA pending completion of USFWS' instream flow studies. Alternatives presented in the DEIS would substantially increase instream flows, correspondingly decreasing CVP water supplies. The federal agencies are currently considering public comments received on the DEIS.

- County groundwater management ordinances adopted in 1999 increased the percentage of California's counties with such ordinances to almost 30 percent. Most of the ordinances post-date the last drought. The numerous groundwater substitution transfers implemented as part of the Department's 1991 and 1992 drought water banks served to heighten local interest in use of county ordinances to control groundwater exports. In 1994, Butte County's ordinance withstood a legal challenge regarding the ability of cities and counties to issue such ordinances, encouraging other counties to consider this approach. The majority of county ordinances regulate groundwater exports from a county, typically by requiring a conditional use permit before export can occur. Permit issuance may be conditioned on findings that export will not result in groundwater overdraft, degrade groundwater quality, or otherwise impact local groundwater resources.

An observation that can be drawn from these changes in laws, regulations, and institutional conditions is that many of them reduce the amount of

supplies historically available to agricultural and urban water users. Under either average water year or 1928-34 drought hydrology, for example, more than 1 maf of developed supply has been reallocated from urban and agricultural purposes to environmental purposes by CVPIA and Order WR 95-6. (This amount does not include reductions in Delta exports due to incidental take limits for listed fish species.) The loss of historically available Colorado River water will further increase the reduction in supplies, unless actions now in planning are implemented.

The long-term outcome of the CALFED Bay-Delta process is difficult to predict at this time. It is conceivable that fishery restoration and enhancement actions planned in the CALFED program, together with those mandated by CVPIA, could improve fishery conditions over the long-term to the point that water users would not experience further water costs due to environmental regulatory actions. In the near-term, CALFED's proposed environmental water purchase program is intended to lessen the impacts of fishery-related operational decisions on CVP and SWP water deliveries.

A significant CALFED-related uncertainty with regard to drought preparedness is the current process for coordinating CVP and SWP operations in the Delta with environmental protection requirements. Since its inception, the CALFED Operations Group has experienced a series of unprecedented wet years.

Its ability to simultaneously manage water and fishery goals has not been tested in a time of water shortage. Wet conditions have allowed CALFED to rely on short-term adaptive management techniques for fishery purposes, an approach not conducive to drought water operations, when multi-year operating plans for conserving reservoir storage are necessary.

### NEW FACILITIES

California's extensive system of water supply infrastructure helps reduce drought impacts, by providing multi-year storage of water supplies and facilitating water transfers and exchanges. Most of California's major urban and agricultural production areas—with the exception of the Salinas Valley—are within reach of a regional conveyance facility or natural waterway that would provide access for water transfers. Table 6 shows new large-scale conveyance facilities constructed or under construction since the last drought. The Department's Coastal Aqueduct

brings a new supply of imported SWP water into the Santa Barbara area, the most adversely affected major urban area during the last drought. Coastal Aqueduct deliveries began in 1997. Mojave Water Agency's two new pipelines convey SWP supplies into parts of its service area previously dependent entirely on limited groundwater resources. MWA additionally augmented its SWP supplies by purchasing 25 taf of entitlement from KCWA, pursuant to Monterey Amendment provisions. When completed in 2004, MWD's Inland Feeder pipeline will help improve water quality in parts of its service area, as discussed in Chapter 2.

Two large water supply reservoirs were constructed since the last drought—MWD's 800 taf Diamond Valley Lake and CCWD's 100 taf Los Vaqueros Reservoir. Both reservoirs are offstream storage facilities with a common purpose of providing emergency water supplies in or near the agencies' service areas, in the event that an earthquake or other natural disaster would make the agencies' imported



*Completion of the remaining 100 miles of the SWP's Coastal Aqueduct from Devils Den to the Santa Maria area in Santa Barbara County links the southern half of the central coast region to California's system of major water infrastructure.*

—TABLE 6—

### New Large-Scale Conveyance Facilities Since Last Drought

Facility	Constructing Agency	Length (miles)	Maximum Capacity (cfs)
Coastal Branch Aqueduct	DWR	100	100
Eastside Reservoir Pipeline	MWD	8	1,000
East Branch Enlargement	DWR	100	2,100*
Mojave River Pipeline	MWA	70	94
Old River Pipelines (Los Vaqueros Project)	Contra Costa Water District	20	400
East Branch Extension**	DWR	14	104
Inland Feeder Project**	MWD	44	1,000
Morongo Basin Pipeline	MWA	71	100
New Melones Water Conveyance Project	Stockton East Water District/ Central San Joaquin Water Conservation District	21	500

\* This initial phase of the enlargement increased capacity of existing facilities by approximately 750 cfs.

\*\* Under Construction

supplies unavailable. CCWD's reservoir stores imported CVP supplies and improves service area water quality; it does not develop new water supplies. Conceptually, half the capacity of MWD's Diamond Valley Lake is to be reserved for emergency storage. The remaining capacity offers the opportunity to develop new supply, by providing storage for wet weather surplus flows or water purchases conveyed by the SWP or CRA. Initial filling of Diamond Valley began in late 1999.

There has been an expansion in groundwater recharge/storage capacity since the last drought. Figure 17 shows some of the larger groundwater recharge/storage projects operating in California today; the projects are described in Table 7. Projects becoming fully operational since the last drought are those operated by SWSD, Arvin-Edison Water Storage District, Kern Water Bank Authority, MWA, and Calleguas Municipal Water District. These new projects rely either wholly or in part on recharge supplies exported from the Delta. Projects' operations are thus subject to Delta export restrictions as well as to the availability of conveyance capacity. If water transfers provide a component of recharge supplies, availability of SWP conveyance capacity becomes a limiting factor on recharge, as discussed in the following section.

The 1987-92 drought enhanced local agency interest in constructing water recycling projects. The increased interest, combined with availability of substantial federal funding through PL 102-575 and PL 104-266, is being reflected in plans to implement projects of regional scale in the State's densely urbanized coastal areas. Accurate data on the statewide increase in new water supplies from recycling since 1990 are not available, but an order of magnitude value would be in the vicinity of 100 taf. Results of a survey of 1995-level recycled water use performed for the Department indicated that agricultural or landscape irrigation amounted to 49 percent of statewide use, and that groundwater recharge amounted to 27 percent.

### CHANGES IN WATER PROJECT OPERATIONS

As discussed earlier, several key events affecting SWP and CVP operations have occurred since the last drought. Events of particular importance to water supply availability include CVPIA implementation, biological opinions for ESA listed fish species, listing of additional fish species, and the Bay-Delta Accord. For example, operations studies performed for the Department's Bulletin 160-98 evaluated the Bay-

—FIGURE 17—

### Examples of Larger California Groundwater Storage Projects



Delta Accord's impact on CVP and SWP operations under 1995-level conditions as compared to similar conditions had D-1485 Delta standards remained in place. The studies, based on 73-year simulations (1922-94), showed that CVP (south of the Delta) and SWP delivery capabilities were significantly reduced. Under D-1485 and 1995 level demands, the CVP had a 40 percent chance of making full contractor delivery requests and a 95 percent chance of delivering 2.0 maf in any given year. Under WR 95-6 with identical demands, the CVP had a 20 percent chance of making full delivery requests and an 80 percent chance of delivering 2.0 maf in any given year. Under D-1485 and 1995 level demands, the SWP had a 70 percent chance of making full delivery requests and a 95 percent chance of delivering 2.0 maf in any given year. Under Order WR 95-6 with identical demands, the SWP had a 65 percent chance of making full delivery requests and an 85 percent chance of delivering 2.0 maf in any given year.

Together, the operations studies indicated the combined 1995 level export capability of the CVP and SWP declined by about 300 taf/yr on average and by about 850 taf/yr during 1929-34 drought hydrology.

The operations studies did not account for Delta export curtailments due to take of ESA listed species or use of CVPIA dedicated water for environmental purposes. Reduction in exports due to take limits can be significant, especially during drought periods, when the projects are unable to export unstored flows or reservoir releases providing required instream flows. The studies also did not account for day-to-day decisions now being made by the CALFED Operations Group regarding coordination of project operations with fishery protection objectives.

CVP operations to deliver the 800 taf of project water dedicated for CVPIA fishery purposes have been a subject of ongoing debate and litigation since enactment of the legislation. Issues have included, for example, the extent to which dedicated water may be used to meet ESA requirements and whether or not dedicated water is available for export when it reaches the Delta. CVP operations to provide the dedicated water, as well as the accounting processes used to identify provision of the water, have varied annually, reflecting the substantial disagreements over how the water would be managed. There is thus no fixed historical baseline from which to accurately measure



*MWD's Diamond Valley Lake is being filled with a mixture of SWP and Colorado River supplies. Initial reservoir filling is expected to be completed by 2002 to 2004, depending on water supply availability. Photo courtesy of MWD.*

—TABLE 7—

### Details of Example Groundwater Storage Projects

Agency and Project Location	Comments
1. Alameda County Water District —Niles Cone, Alameda County	Seawater intrusion management. District recharges imported surface supplies from its SWP 42 taf annual contractual entitlement and from San Francisco's Hetch Hetchy Aqueduct.
2. Arvin-Edison Water Storage District —Kern County	A 350 taf banking program is being developed with MWD. Estimated extraction capability is 40-75 taf/year.
3. Calleguas Municipal Water District —Las Posas Basin, Ventura County	Uses injection wells to recharge its imported MWD supplies. Maximum storage capacity of 300 taf. At full implementation, maximum annual extraction rate estimated to be 72 taf. Providing local emergency storage is a major project purpose.
4. City of Bakersfield—Kern River fan area, Kern County	Initial operation of 2,800 acre recharge facility began in 1978. City has rights to Kern River water, and long-term contracts with three water agencies, who store and extract water in coordination with the city.
5. Coachella Valley Water District —Upper Coachella Valley, Whitewater River channel area	Recharge from local Whitewater River supplies and from MWD's imported Colorado River Aqueduct water exchanged for SWP contractual entitlements of CVWD and Desert Water Agency.
6. Kern Water Bank Authority—Kern River fan area, Kern County	3,000 acres of recharge basins. The Authority is a joint-powers agency which operates the project on behalf of local water agencies. Recharge supplies may be local surface water or imported supplies.
7. Los Angeles County Department of Public Works—Los Angeles River and San Gabriel River watersheds, Los Angeles County	Extensive recharge facilities employing about 2,400 acres of spreading areas, and injection wells at three seawater intrusion barriers (Alamitos, Dominguez Gap, and West Coast). County operates the river systems for the dual purpose of flood control and groundwater recharge, and also recharges imported and recycled water provided by others.
8. Monterey County Water Resources Agency—Salinas River Valley, Monterey County	Releases from MCWRA's Nacimiento and San Antonio Reservoirs are managed to provide recharge for upper valley. MCWRA distributes recycled water produced by the Monterey Regional Water Pollution Control Agency for in-lieu recharge in the lower valley, to help reduce seawater intrusion. MCWRA's 45-mile distribution system can convey 19.5 taf of recycled water.

—TABLE 7 CONT'D—

### Details of Example Groundwater Storage Projects, cont'd

Agency and Project Location	Comments
9. Mojave Water Agency—Mojave River Basin, San Bernardino County	Basin has been adjudicated by court. The ephemeral Mojave River is the only local surface supply. To reduce overdraft, MWA's two new 71-mile pipelines import SWP supplies for recharge in spreading areas in the river channel. MWA's initial SWP contractual entitlement of 50.8 taf annually was augmented by the 1997 purchase of an additional 25 taf of annual entitlement.
10. Orange County Water District—Santa Ana River watershed, Orange and Riverside Counties	Recharges Santa Ana River water regulated at Prado Dam, also recharges recycled water. Operates series of recharge basins along lower river and two seawater intrusion barriers. One barrier is jointly operated with Los Angeles County. Typically recharges about 300 taf annually.
11. Santa Clara Valley Water District—Santa Clara County	District formed in 1929 to combat declining groundwater levels and associated land subsidence. Has 20 recharge basins covering about 390 acres, and also recharges in stream channels. District typically recharges over 100 taf annually, with a combination of local and imported supplies. Estimated operational storage is 550 taf.
12. Semitropic Water Storage District—Kern County	Banking (in-lieu recharge) program with 1 maf storage capacity. Banking partners include MWD (350 taf), Santa Clara Valley WD (350 taf), Alameda County WD (50 taf), Zone 7 Water Agency (65 taf), and Vidler Water Company (185 taf).
13. United Water Conservation District—Santa Clara River Watershed, Ventura County	Operates Lake Piru on Piru Creek and Freeman Diversion Dam on the Santa Clara River in conjunction with spreading areas at Saticoy, El Rio, and Piru.
14. Zone 7 Water Agency—Alameda County	Recharges imported SWP water (46 taf annual contractual entitlement) in local stream channels.

impacts of implementing the requirement. The most apparent impact to CVP water users has been a reduction in deliveries to agricultural users in the Delta export service area on the west side of the San Joaquin Valley. To the extent that the SWP assists USBR in implementing dedicated water operation by

forgoing export of unstored water otherwise available for SWP export in the Delta, there are also SWP water costs associated with CVPIA implementation. Water project operations associated with dedicated water remain a subject of discussion in the CALFED Operations Group.

Under present CVP operations, agricultural contractors in the Delta export service area are expected to receive about 50 percent of contractual entitlements in above normal water years. Using the 2000 irrigation season as an example, the early forecast of deliveries to these contractors was at the 30 percent level due to the absence of rain through January. The forecast was subsequently revised to 50 percent in response to a wet February and early March. This allocation was later again increased to 65 percent partly as a result of the CVP's ability to use the recently obtained joint point of diversion permit with the SWP. (The SWP diverted water at Banks Pumping Plant during March and April for the CVP.)

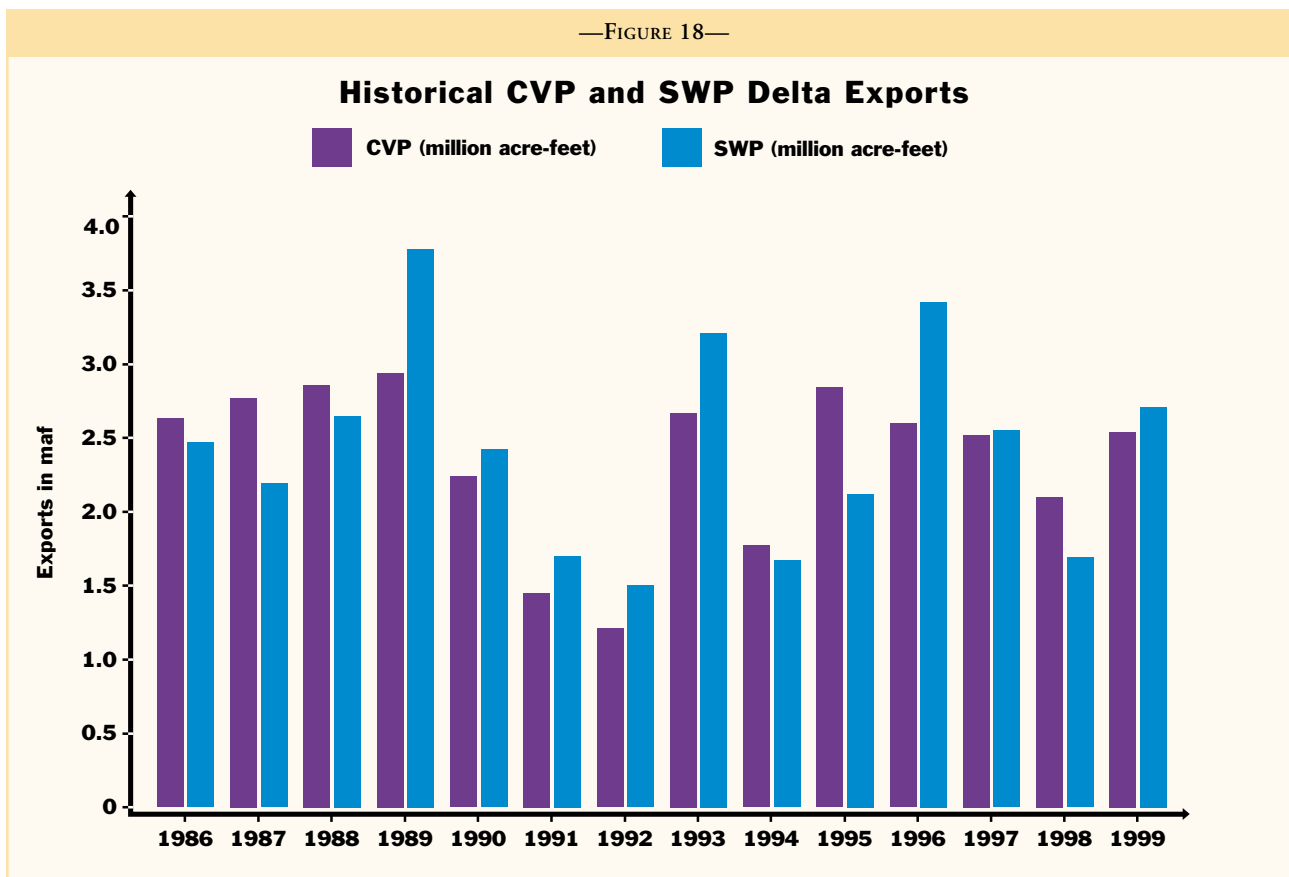
Figure 18 shows historical CVP and SWP exports from the Delta. It is not possible to quantify the operational changes' drought year impacts to CVP and

SWP delivery capabilities. Current project operations have been taking place in the context of wet year water conditions under a constantly changing regulatory framework (*i.e.*, fish protection decisions made in the CALFED Operations Group). The CALFED program is in a transitional state from planning to implementation. The Bay-Delta Accord will expire in September 2000; discussions remain ongoing as to the governance structure that could replace it, including how the function now performed by the CALFED Operations Group might be institutionalized. CALFED discussions on creation of an environmental water account are in progress. The success of this program, which entails acquisition of perhaps as much as 400 taf of water from willing sellers to use in meeting ecosystem goals, may affect regulatory decisions on water project operations, as well as the availability of



*The Delta Cross Channel, a CVP facility constructed in 1951, was designed to help move water from the Sacramento River into the southern Delta. A gated inlet structure (left side of photo) on the Sacramento River about 1 mile north of Walnut Grove is operated to divert river water into a 4,200 foot-long channel connecting the Sacramento River to Snodgrass Slough, part of the Mokelumne River system. Maximum diversion capacity is about 3,500 cfs. SWRCB Order WR 95-6 requires that the Cross Channel gates be closed more frequently, to keep migrating salmon in the Sacramento River.*

—FIGURE 18—



water for future drought water banks. Also pending are petitions for reconsideration of SWRCB's Bay-Delta partial water rights decision, which continued the assignment of responsibility for meeting Order WR 95-6 water quality standards to the SWP and CVP, rather than sharing that burden among other Delta diverters.

CVP and SWP operations in 1999 and 2000 provide an example of uncertainties created by the changed regulatory framework. In 1999, SWP exports in late spring/early summer were curtailed due to high Delta smelt densities in the South Delta. The curtailment deferred San Luis Reservoir filling, subsequently resulting in a loss of about 150 taf of interruptible water for SWP contractors. In 2000, unusually wet conditions in February and early March were followed by dry weather. The initial wet conditions triggered the Order WR 95-6 X2 (salinity) requirement for Suisun Bay in April and early May, but natural runoff was subsequently insufficient to sustain the requirement. The SWP had to release water stored in Lake Oroville to meet the requirement. This additional release from storage, coupled with a lower runoff forecast, led to a reduction of ten percent in contractors' allocations.

#### CHANGES AFFECTING DROUGHT WATER BANK AND WATER TRANSFERS

Changed Delta operating conditions due to factors such as Order WR 95-6, CVPIA, and ESA also restrict the ability to use SWP (or CVP) facilities to wheel drought water bank deliveries or non-project water transfers across the Delta, in addition to reducing supplies available to both projects' contractors. Figure 19 shows historical levels of California Aqueduct wheeling, together with water year type. The majority of the Department's historical wheeling has been for the CVP, Cross Valley Canal water users, and SWP contractors. Future quantities of water wheeled for the CVP and for SWP contractors may increase, reflecting ability to use the DWR/USBR joint point of diversion permit and implementation of the SWP's Monterey Amendments. Implementing CALFED's environmental water account is also expected to entail use of aqueduct capacity.

Drought water bank operations will probably be further constrained by lessened ability to acquire water through groundwater substitution transfers. Land fallowing and groundwater substitution, both of which created substantial local concerns over third-party impacts in 1991 and 1992, were the largest sources of water for those drought water banks. Enactment of

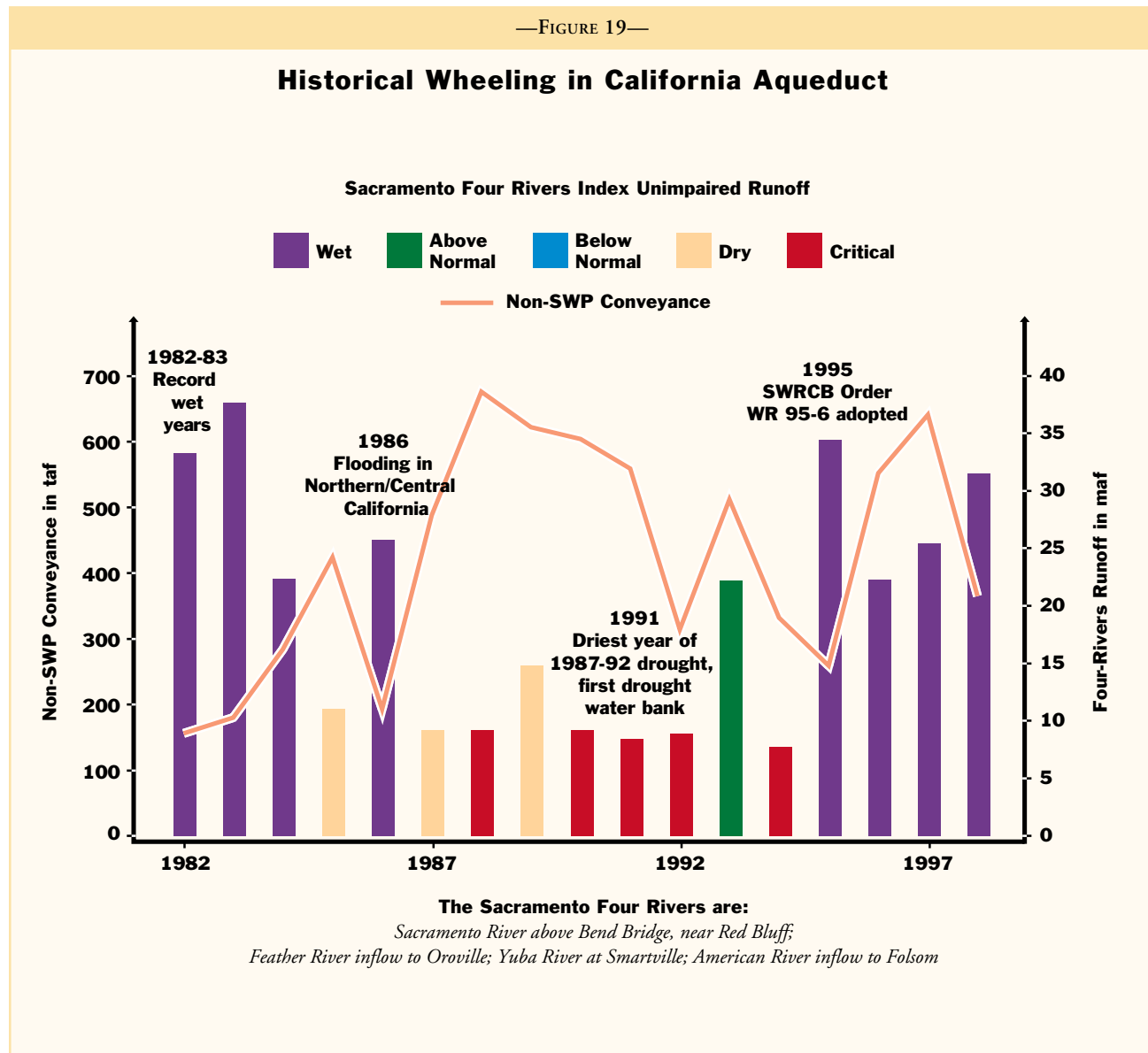
county groundwater management ordinances and past local opposition to groundwater substitution transfers for the SWP suggest limited ability to acquire water from this source within the timeframe of this report. In the short-term, the most likely sources of drought water bank purchases would be water stored in reservoirs or ground water basins south of the Delta.

Water agencies' and private entities' plans for water transfers involving use of California Aqueduct capacity continue to increase. The development of additional groundwater recharge/storage projects south of the Delta will likely contribute to increased requests for wheeling non-project water. The Water Code requires that public agencies, including the Department, make available unused conveyance capacity of their facilities, subject to payment of fair

compensation and other conditions (see sidebar). However, availability of unused capacity is significantly constrained, and the amount and timing of availability of future unused capacity cannot be predicted with any certainty. It may now be time for the Department to establish formal priorities for non-project wheeling, to help provide potential water transferors with a clear understanding of factors affecting availability of capacity.

Use of aqueduct capacity is first reserved for delivering SWP water. The quantities of project water to be delivered are established through an iterative process of matching contractors' requested delivery schedules against hydrologic conditions and facility delivery capabilities. This process is then balanced against constraints on moving water across the

—FIGURE 19—



Delta—such as Order WR 95-6 export limits, incidental take provisions for ESA listed species, and other requirements of ESA biological opinions. Operational needs associated with existing agreements for conveyance of non-project water, such as those with Cross-Valley Canal water users, must also be considered. In 2000, for example, it is estimated that October will be the earliest time that unused capacity is available for new wheeling.

The magnitude of potential transfers involving SWP facilities is significant. SWP contractors are making greater use of aqueduct capacity to wheel non-project water, as provided in the Monterey Amendments. MWD, for example, issued a request for proposals in December 1999 for its “California Aqueduct Dry Year Transfer Program”, a proposed program seeking purchases of 100 taf per year of transfer options. The program is intended to be operational by 2003. Transfers, including water purchases and exchanges for fishery purposes, are a component of CALFED program implementation. Development of groundwater storage and conjunctive use programs is currently an area of expanding interest—in addition to being a component of the Department’s integrated storage investigations program, groundwater recharge and storage activities are authorized to receive \$230 million in financial assistance from Proposition 13 bond funds. The majority of likely storage sites are located in the San Joaquin Valley and in Southern California, where implementing conjunctive use programs often entails use of California Aqueduct conveyance capacity.

### **CHANGES IN WATER USE CONDITIONS**

Statewide or region-wide changes in actual water usage are best viewed over the long-term, because factors such as weather, hydrology, economic conditions, or regulatory changes can lead to significant

annual fluctuations in water use, obscuring long-term trends. A notable example of annual water use fluctuation was the change in California agricultural water use between 1983 and 1984. In 1983, California irrigated acreage dropped by 900,000 acres (almost ten percent of total statewide acreage) due to widespread flooding and operation of the U.S. Department of Agriculture’s Payment in Kind program, resulting in a corresponding drop in agricultural water use. Irrigated acreage subsequently rebounded by 800,000 acres in 1984, and water use likewise rebounded. Another example of annual influences on water use is spring hydrologic conditions—an unusually wet or dry spring can significantly influence both agricultural and urban water use in that year.

Demographic trends affect water use patterns. California’s population has increased by more than 6 million people since 1987, the first year of the last drought. According to the Department of Finance, California’s population growth is shifting from the State’s densely urbanized coastal areas to inland regions. Urban per capita water use is higher in the State’s inland regions than it is in coastal areas, reflecting higher landscape water use due to warmer and dryer climatic conditions. Regions expected to have the highest percent growth rates over the next 20 years are the Inland Empire, Central Valley, and Sierra Nevada foothills. As greater development occurs in these inland areas, the ex-urban ring around them also expands. From a drought management perspective, the flight from suburban areas to low-density rural developments in areas such as the Sierra Nevada foothills is significant.

Past drought experience demonstrated that genuine health and safety problems (running out of water for drinking, sanitation, and fire fighting) are most likely to occur in small, rural communities relying on marginal water sources, and for individual

### **THE 1994 CALIFORNIA AQUEDUCT PUMP-IN PROGRAM**

The most recent drought was followed by a wet 1993, but 1994 reverted to critically dry conditions. Water users once again implemented strategies to augment supplies or reduce demands. To help meet water users’ needs, the Department and USBR allowed local groundwater to be pumped into the joint State-federal San Luis Canal reach of the aqueduct. The program allowed water users to redistribute groundwater supplies within water districts, and allowed State or federal water contractors to receive supplies delivered from San Luis Reservoir in exchange for a like amount of groundwater pumped into the aqueduct. During calendar year 1994, aqueduct pump-ins within Westlands Water District and San Luis Water District totaled 99,390 af. The magnitude of the pump-ins subsequently raised concerns about water quality impacts to SWP contractors and increased rates of land subsidence. No subsequent pump-in programs have been conducted.

## WATER CODE SECTION 1810 ET SEQ.

1810. Notwithstanding any other provision of law, neither the state, nor any regional or local public agency may deny a bona fide transferor of water the use of a water conveyance facility which has unused capacity, for the period of time for which that capacity is available, if fair compensation is paid for that use, subject to the following:

- (a) Any person or public agency that has a long-term water service contract with or the right to receive water from the owner of the conveyance facility shall have the right to use any unused capacity prior to any bona fide transferor.
- (b) The commingling of transferred water does not result in a diminution of the beneficial uses or quality of the water in the facility, except that the transferor may, at the transferor's own expense, provide for treatment to prevent the diminution, and the transferred water is of substantially the same quality as the water in the facility.
- (c) Any person or public agency that has a water service contract with or the right to receive water from the owner of the conveyance facility who has an emergency need may utilize the unused capacity that was made available pursuant to this section for the duration of the emergency.
- (d) This use of a water conveyance facility is to be made without injuring any legal user of water and without unreasonably affecting fish, wildlife, or other instream beneficial uses and

without unreasonably affecting the overall economy or the environment of the county from which the water is being transferred.

1811. As used in this article, the following terms shall have the following meanings:

- (a) "Bona fide transferor" means a person or public agency as defined in Section 20009 of the Government Code with a contract for sale of water which may be conditioned upon the acquisition of conveyance facility capacity to convey the water that is the subject of the contract.
- (b) "Emergency" means a sudden occurrence such as a storm, flood, fire, or an unexpected equipment outage impairing the ability of a person or public agency to make water deliveries.
- (c) "Fair compensation" means the reasonable charges incurred by the owner of the conveyance system, including capital, operation, maintenance, and replacement costs, increased costs from any necessitated purchase of supplemental power, and including reasonable credit for any offsetting benefits for the use of the conveyance system.
- (d) "Replacement costs" means the reasonable portion of costs associated with material acquisition for the correction of unrepairable wear or other deterioration of conveyance facility parts which have an anticipated life which is less than the conveyance facility

repayment period and which costs are attributable to the proposed use.

- (e) "Unused capacity" means space that is available within the operational limits of the conveyance system and which the owner is not using during the period for which the transfer is proposed and which space is sufficient to convey the quantity of water proposed to be transferred.

1812. The state, regional, or local public agency owning the water conveyance facility shall in a timely manner determine the following:

- (a) The amount and availability of unused capacity.
- (b) The terms and conditions, including operation and maintenance requirements and scheduling, quality requirements, term or use, priorities, and fair compensation.

1813. In making the determinations required by this article, the respective public agency shall act in a reasonable manner consistent with the requirements of law to facilitate the voluntary sale, lease, or exchange of water and shall support its determinations by written findings. In any judicial action challenging any determination made under this article the court shall consider all relevant evidence, and the court shall give due consideration to the purposes and policies of this article. In any such case the court shall sustain the determination of the public agency if it finds that the determination is supported by substantial evidence.

1814. This article shall apply to only 70 percent of the unused capacity.

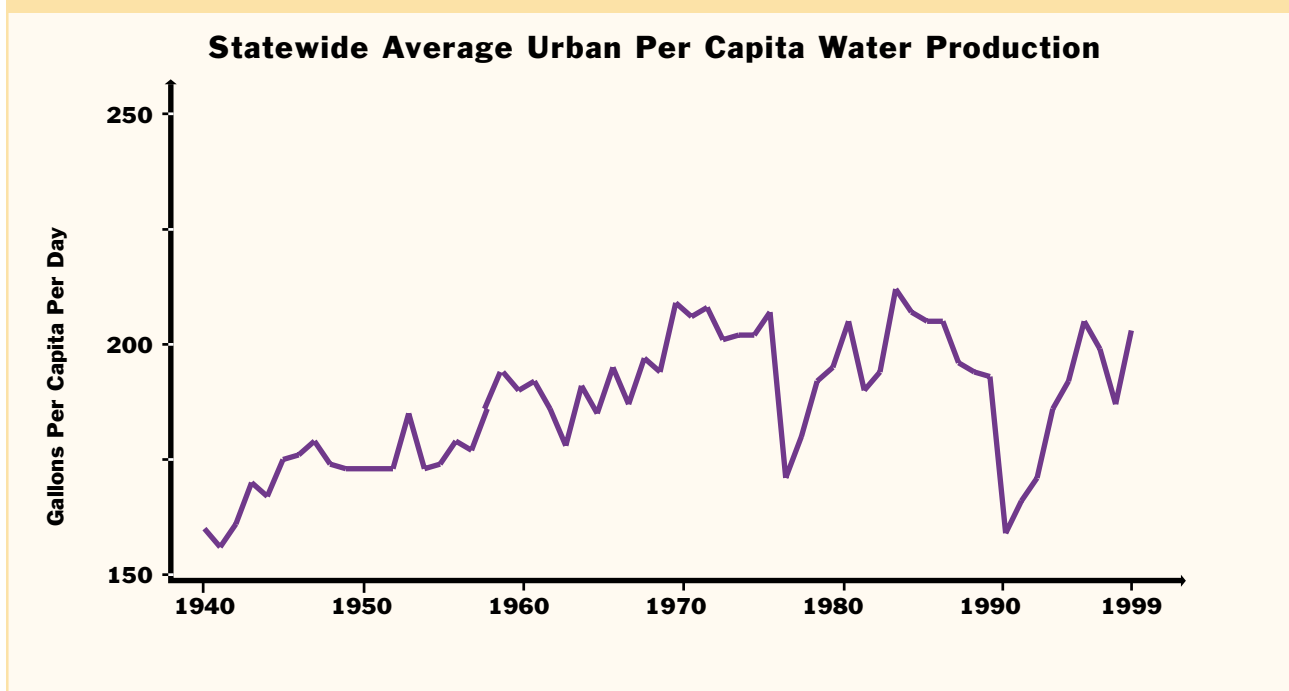
rural homeowners whose wells rely on groundwater in low-yield rock formations. Rural areas are typically characterized by small, geographically dispersed population centers and the absence of a financial base for major capital improvements or interconnection with other water systems. Groundwater resources from fractured rock sources in the Sierran foothills are highly variable in terms of quantity and quality, and are uncertain sources for substantial residential development. The substantial increase in the number of new wells constructed during the last drought—the majority of them for residential use—illustrates drought impacts to rural homeowners.

The potential for demand hardening in California's large urbanized areas is another trend to monitor. Demand hardening occurs when agencies implement water conservation programs that result in permanent reductions in water use, such as retrofitting plumbing fixtures or installing low water use landscaping. These measures lessen agencies' ability to implement rationing to reduce water use during droughts, and can result in greater impacts to urban water users (*e.g.*, loss of residential landscaping) when rationing is imposed. For example, the extensive Los Angeles retrofit program helped the city maintain reductions in urban per capita water use it achieved during the last drought. These permanent water use reductions will make it more difficult for the city to duplicate its previous 15 percent water use reduction goal during a future drought.

Figure 20 shows statewide population-weighted average urban per capita water production over time, based on the Department's annual surveys of urban water retailers. The drop in per capita water production during both the 1976–77 and 1987–92 droughts is apparent, as is a post-drought rebound in production. Statewide per capita production declined by about 19 percent during the 1987–92 drought. Figure 21 contrasts total water production and population growth for two Southern California cities—Los Angeles and Ontario. Water production in Los Angeles declined during the drought and did not rebound, diverging from the trend of increasing population. Ontario's water production declined only during the driest year of the drought (1991), but otherwise continued to trend with population increases. The difference between the two cities is explained by Los Angeles' aggressive program to retrofit its older housing stock with low water use plumbing fixtures, aided by a substantial infusion of State financial assistance.

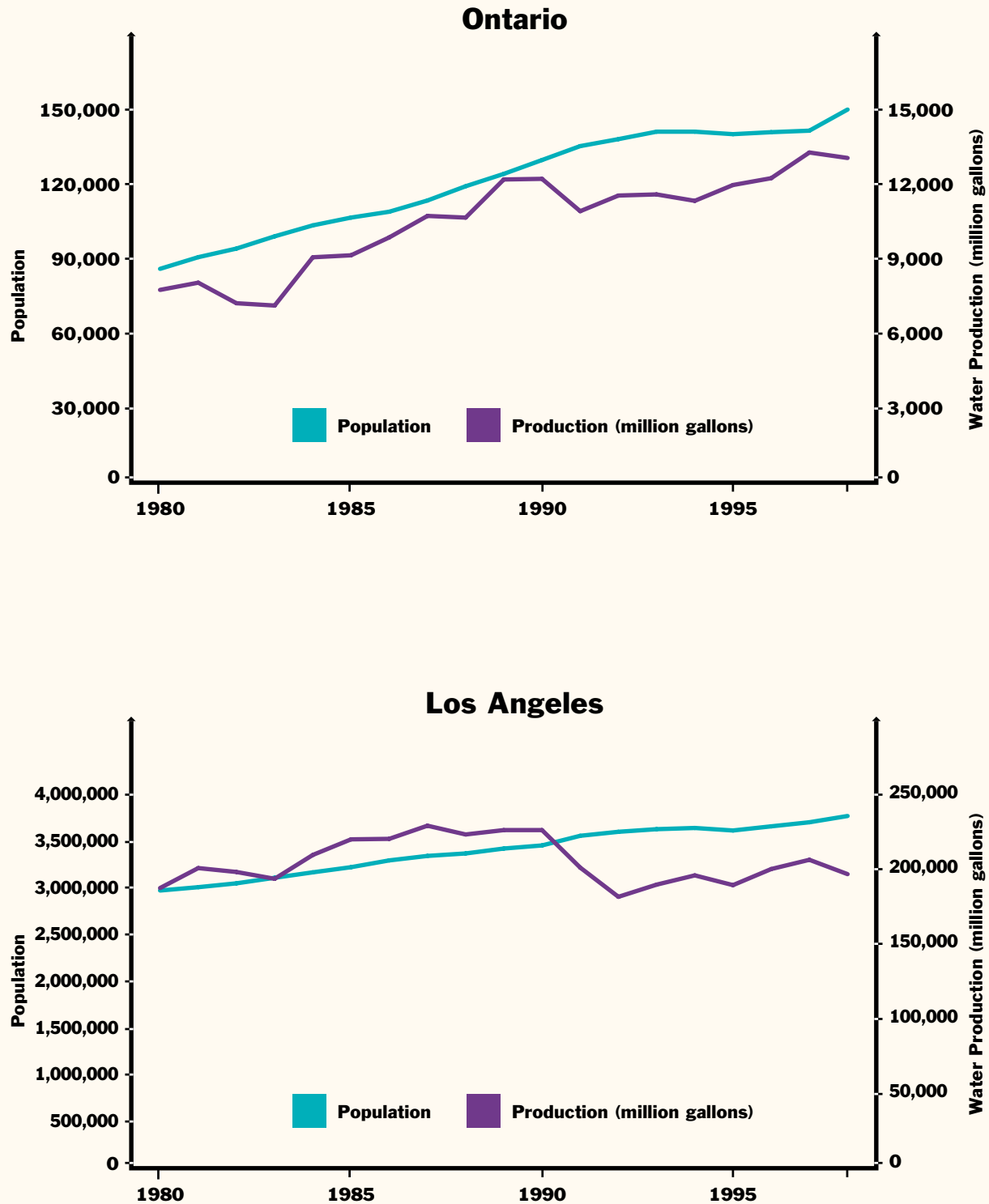
Demand hardening also applies to agricultural water use. Water demands harden as growers shift from field and row crops to permanent plantings of orchards and vineyards. A field normally planted in row crops can be fallowed in a water-short year. In contrast, withholding water from permanent plantings will ultimately result in loss of a grower's capital investment. California's acreage of permanent

—FIGURE 20—

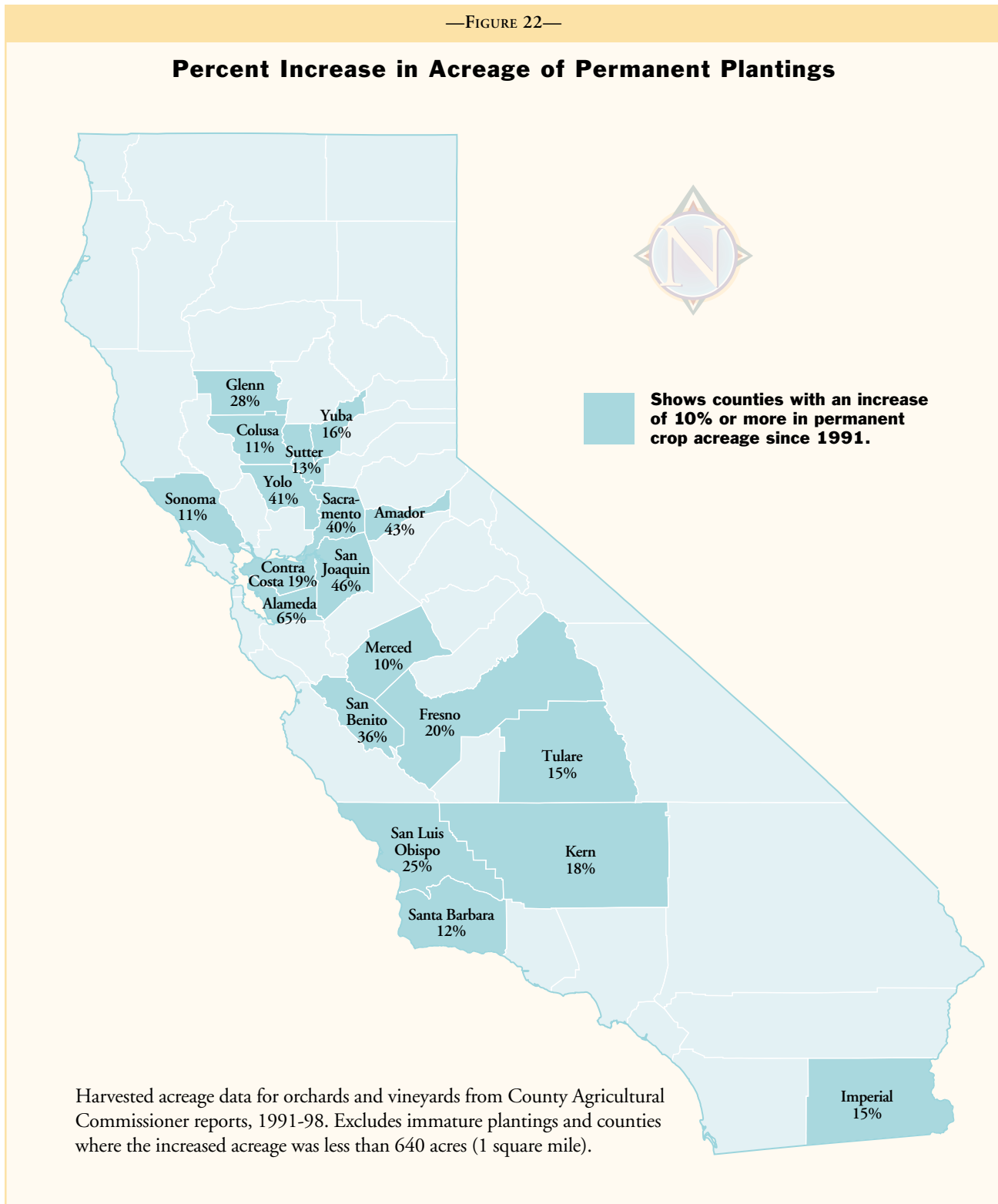


—FIGURE 21—

### Examples of Water Production and Population Growth in Two South Coast Cities



—FIGURE 22—



plantings has increased since the last drought, as indicated in Figure 22. Much of this increase is in response to recent market conditions favoring production of grapes, almonds, and pistachios. The market for California's crops—internationally as well as nationally—is a driving factor in growers' planting

decisions. A region's crop mix can change significantly over a time period as short as five to ten years, in response to changing market conditions.

From a drought planning perspective, two classes of permanent plantings stand out—vineyards installed in areas historically having limited

agricultural water supplies, and most plantings in the San Joaquin Valley. Vineyard acreage in Amador and San Luis Obispo Counties, for example, is up by 36-37 percent since the last drought. Agricultural water users in the San Joaquin Valley rely significantly on Delta exports and on overdrafted groundwater basins. The San Joaquin Valley is also the area experiencing the greatest increase in acreage of permanent plantings since the last drought—more than 230,000 acres. Much of this increase has occurred on the Westside, within the water-short CVP Delta export service area.

### **NEAR-TERM ACTIONS NOW IN PLANNING**

Some programs or actions now in planning stages could affect regional or statewide drought preparedness within the next five to ten years. The CALFED Bay-Delta program is one such example; water project operations uncertainties associated with its implementation and with SWRCB's Bay-Delta water rights proceedings were described earlier. This section highlights a few other programmatic actions now at or near an implementation stage, actions that have a bearing on drought preparedness planning.

#### ***Emergency Storage Programs***

Urban water agencies at risk for seismic disruption of imported supplies have increasingly been evaluating emergency storage programs. These programs typically entail plans to store perhaps six months' to a year's worth of supplies in or near agencies' service areas; some are sized to provide supplies during prolonged droughts as well as during outages of lifeline facilities. Both MWD's Diamond Valley Lake and CCWD's Los Vaqueros Reservoir, for example, incorporate emergency storage functions in their operation. Calleguas Municipal Water District's aquifer storage program, now in initial implementation, is intended to provide storage within Calleguas' service area in the event of loss of supply from MWD's distribution system. (Calleguas is located at the western terminus of MWD's distribution system.) SDCWA is beginning construction of its emergency storage project, which entails construction of Olivenhain Reservoir in partnership with Olivenhain Municipal Water District and enlargement of Lake Hodges and San Vicente Reservoir. The project would provide about 90 taf of emergency storage. Emergency storage is particularly important to San Diego, because the county is highly dependent on imported supplies. Bay Area urban

agencies such as EBMUD and the San Francisco Public Utility Commission have also performed appraisal-level studies to examine needs for in-service area emergency storage, but have not gone forward with projects.

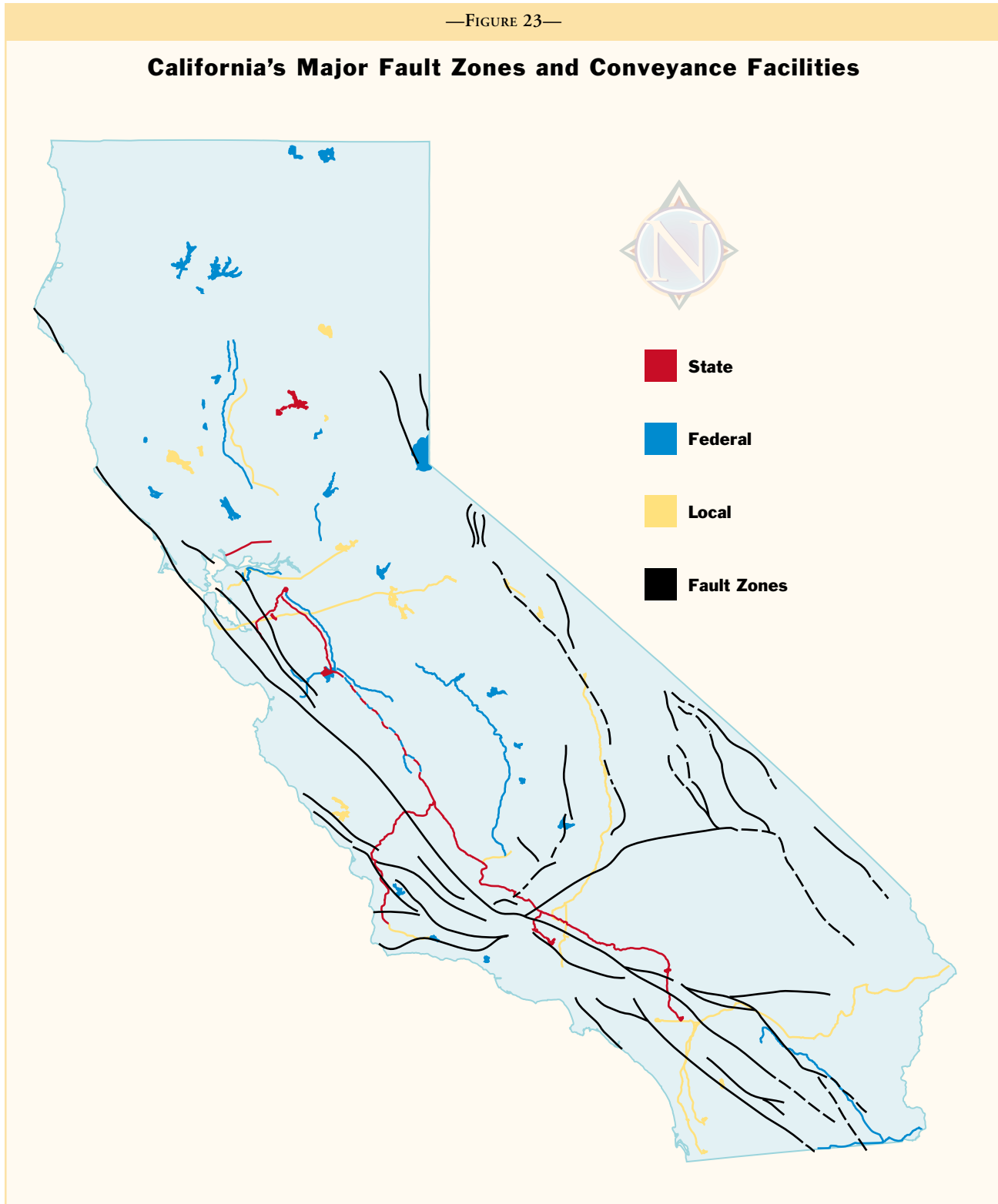
From a lifeline engineering perspective, the potential need for emergency storage projects is demonstrated by Figure 23, which superimposes locations of some of California's significant fault zones on a map of regional water facilities.

#### ***Groundwater Storage Projects***

Large-scale groundwater recharge and storage projects now operating in California were described previously. Local agency projects now in various stages of planning include those associated with development of California's Colorado River Water Use Plan. Projects in this category are the Cadiz Valley/Fenner Valley project (draft environmental documentation released in 1999) and the Hayfield/Chuckwalla and lower Coachella Valley projects (both in testing stages). The projects would entail using MWD's aqueduct to convey surplus Colorado River water, when available, for recharge at the sites. The Cadiz/Fenner project would involve construction of about 35 miles of pipeline to link the valleys with the aqueduct. The project's estimated storage/extraction capacity would be about 150 taf per year, which could include extraction of some native groundwater together with stored Colorado River water. In Hayfield Valley, MWD is carrying out a demonstration project that would entail completing 100 taf of recharge this year. Implementing the full-scale project would require additional land acquisition. MWD estimates that the project could be fully operational in 2005, with 800 taf of water in storage by that time. In addition to investigating a new recharge site in the Lower Coachella Valley, MWD, Coachella Valley Water District, and Desert Water Agency are also considering expansion of the existing Windy Point recharge facilities in the upper valley.

The Colorado River Water Use Plan includes interstate groundwater banking in Arizona, pursuant to 1996 Arizona legislation allowing interstate banking under specified conditions. The Secretary of the Interior promulgated final regulations for interstate banking in 1999. Interstate withdrawals from the bank are limited to 100 taf per year; there is no limitation on annual deposits. Prior to enactment of the state legislation, MWD had established a test banking program in Arizona, storing about 89 taf there.

—FIGURE 23—



San Joaquin Valley banking locations are also being investigated. For example, Azurix Corporation is attempting to develop a water bank at a site in Madera County previously considered by USBR. The project examined by USBR would have had a storage capacity of about 400 taf, with the recharge source

being wet year surplus water conveyed through CVP facilities. In San Joaquin County, water users have engaged in discussions with EBMUD about storage of EBMUD's Mokelumne River supplies or its CVP supply from the American River in county groundwater basins. The \$230 million of funding for

groundwater recharge/storage programs provided by enactment of Proposition 13 will accelerate implementation of local agency projects now in planning stages. The Department's integrated storage investigations program also includes a component for cooperating with local agencies in developing groundwater storage projects.

### ***Coordination of Land Use and Water Supply Planning at the Local Government Level***

Interest in better coordination between land use planning performed by cities and counties and water supply planning performed by special districts is increasing, especially in areas experiencing significant development pressure. This subject was first addressed legislatively in 1995, with a requirement that cities and counties making specified land use decisions, such

as amending a general plan, consult with local water agencies to determine if supplies are available, and to disclose findings through the California Environmental Quality Act process.

In its January 2000 report, *Growth Within Bounds*, the Commission on Local Governance for the 21<sup>st</sup> Century made several recommendations relating to orderly growth and the provision of infrastructure, including calling for a more proactive role by local agency formation commissions and for strengthening the linkage between local land use and water supply planning. In the context of drought preparedness, a stronger linkage would be particularly beneficial in the rural counties experiencing suburban flight from rapidly growing inland areas of the state. As indicated earlier, the low population densities and lack of ability to interconnect many small water systems makes these areas vulnerable to drought impacts.



*Orange County Water District groundwater recharge facilities on the Santa Ana River. Proposition 13, approved by the voters in March 2000, provides \$230 million of financial assistance for implementing local agency groundwater storage and recharge projects.*